

ABSTRACT

An NQR scanner for detecting the presence of a substance containing quadrupole nuclei within an object. A pulse generating means (1) generates pulse sequences that are used to irradiate the object in a pulsed magnetic field at a requisite NQR frequency for the substance to be detected. A high power RF transmit amplifier (2) amplifies the signal to produce sufficient magnetic field strength to irradiate a scan volume within which the object is disposed for detection purposes and cause an NQR transition to a detectable level within the substance if present within the object. A high Q, tuneable coil (5) producing a reasonably uniform magnetic field over the entire scan volume, is connected into a tuneable circuit including fixed capacitor(s) (6), a low ESR switch (7,8) and tuning capacitors (9) for varying the resonant frequency thereof. A power matching unit (3) ensures optimum power transfer from the transmit amplifier (2) to the coil (5) at substantially every frequency the NQR scanner operates. An electromagnetic shield (55) fully encloses the coil (5) allowing an opening to pass the object into the scan volume for detection. A tuning subsystem including a tuning probe (28) determines if the introduction of the object into the scan volume has altered the resonant frequency of the scanning for the substance, and to re-tune the scanner to the requisite resonant frequency. A receiver system including an amplifier (10, 19) for amplifying a received signal from the coil after a delay from each pulse of the pulse sequence causing irradiation of the object and a mixer (11) for treating the received signal to improve the SNR. Processing means (12, 13) to process the treated signal to separate out the phase and amplitude thereof and control the pulse generating means (1). An isolator (4) isolates the coil (5) from the receiver system. A comparator (13) compares the measured phase and amplitude of the received signal with a known range or prescribed threshold. A detector detects whether the measured signal corresponds to an NQR signal emitted by the nuclei of the substance being tested, and if present issues an alarm to notify an operator of the scanner that the substance has been detected. A method for detecting the presence of a substance containing quadrupole nuclei within an object is also described.